In-Service Partial Discharge Testing: The Right Tool at the Right Time

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Internal PD activity involves a deterioration of surrounding materials and may in the long term lead to a total breakdown of the insulating system...

“Constant dripping wears away the stone”
**PD Detection techniques**

- **Electrical PD**
  - moving charges = electric current
- **Optical**
  - light
- **Acoustic**
  - sound
- **Thermal**
  - heat
- **Chemical**
  - DGA
- **Electro-magnetic**
  - Radio and other waves

- Need to generate **data** which can help us **detect PD sources**, and work out what we **need to do** and **how soon to do it**
- **Survey – Test - Monitor**
Advantages of RFI Survey

- No outage needed for access, and equipment does not need to be taken out of service
- Cost-effective and time-efficient
- May be adopted for first-line substation surveillance
- Rate and severity of discharge can be trended

- Performs frequency scan 50 MHz to 1000 MHz
  - Surface PD RFI significantly impacts 50-250 MHz range.
  - Internal PD emits RFI 250-1000 MHz +
- Higher frequency RFI signals attenuate over distance (e.g. more sensitive to proximity).
  - Focusing on the highest elevated frequencies may be useful for finding the source
Establish baseline scan outside of substation. Do additional survey scans at planned locations inside the substation.

Overlay survey scans and baseline using the PDS Viewer software. Look for broadband increases in RF energy.

Return to survey locations that show elevated readings. Approach other equipment in the area to see if readings intensify (aka “the hot-cold method”).

Use Directional antenna to focus
Points of Interest:

- High amplitude compared to baseline reading.
- High frequency
  - Too high to be corona
Focused surveys using a variety of sensors

Handheld RFI PD Detector

HFCT Ground,

TEV

GIS

Drain Valve

Bank of 3 HFCT’s

Directional Antenna
Acoustic Survey Tools

- Use airborne microphone for more general survey
- Use with contact microphone (piezo-electric) for more focused survey
- Combination of RFI and acoustic can be very effective
Using both acoustic and TEV
Acoustic gave better discrimination of compartment with PD source
Survey: Condition – Action - Timescale

- Survey tools provide data
  - may indicate a metalclad compartment or an individual piece of equipment

- Diagnosing PD is the first step – action is required as a follow up

- Action may be:
  - Ignore
  - Detailed testing
  - Monitoring
• For a given frequency range, generate a spectrum for each channel
• Configure channels individually – frequency range and sensor
• Generate PD statistics:
  • Ipwr = Integrated Power
  • PAPR = Peak/Average power ratio
• Generate statistics for:
  • Overall spectrum
  • Sub bands
• True monitoring capability:
  • Look for statistical variation
  • Generate alarms
Discussion

- PD – easy to make a start, get useful information
- Signals require interpretation
- Survey tools work well in identifying problems
Questions?

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